mitigate significant impacts have been identified for public safety and services and there would be no residual significant impacts.

3.18 NOISE

This section describes the existing noise environment at and in the vicinity of the proposed power plant site, and assesses potential noise impacts associated with the Proposed Action and alternatives. Noise-sensitive receptors that may be affected by noise are identified, as well as the laws, ordinances, regulations, and standards that regulate noise levels at those receptors. The following discussion describes the results of sound level measurements, acoustical calculations, and assessment of potential noise impacts. Where appropriate, mitigation measures are proposed to reduce potential Project-related noise impacts to acceptable levels.

3.18.1 Affected Environment

Noise-sensitive receptors are land uses associated with indoor and outdoor activities that may be subject to stress or significant interference from noise. They often include residential dwellings, mobile homes, hotels, motels, hospitals, nursing homes, educational facilities, and libraries. Industrial, commercial, and agricultural and undeveloped land uses generally are not considered sensitive to ambient noise. A land use map (Figure 3.7-1) that identifies residences and other land uses where quiet is an important attribute of the environment within the region of influence is located in Section 3.7.

The general area surrounding the proposed power plant site, pipelines, and associated facilities varies from flat areas, to rolling hills, to fairly mountainous and rocky terrain east of the proposed power plant site. The area is primarily open rangeland that is undeveloped or grazed by livestock and/or wild burros. The general area shows evidence of some vehicle traffic; however, the disturbance appears predominantly limited to small areas (e.g., near well sites). The developed uses in the vicinity are limited to the Mead-Phoenix Project 500-kV transmission line, the Phelps Dodge water pipeline, scattered water wells, a clay mining operation, and one residence. The residence is located approximately 1 mile southwest of the proposed power plant site (and directly east of the proposed wells and agricultural use).

Land uses along the proposed pipeline corridor are primarily open space. There are four residences within corridor segment T5 just east of the Big Sandy River crossing. West of the Big Sandy River, there are six residences located within corridor segment T4. Five additional residences are located just outside the corridor, generally located along the highway. There is only one residence located in corridor segment T3. There is one residence along Hackberry Road, but it is outside the corridor.

There are approximately 41 residences dispersed along US 93 (R3, R4, and R5). There is also a small subdivision, Sierra Vista Estates, south of I-40 in T20N, R14W, Sections 12 and 13, which is approximately 0.75 miles west of the Mead-Liberty 345-kV transmission line and one residence just east of corridor segment T2.

3.18.1.1 Fundamentals of Acoustics

Noise generally is defined as loud, unpleasant, unexpected, or undesired sound that disrupts or interferes with normal human activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, the perceived importance of the noise and its appropriateness in the setting, the time of day and the type of activity during which the noise occurs, and the sensitivity of the individual.

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Sound generally is characterized by a number of

variables including frequency and intensity. Frequency describes the sound's pitch and is measured in Hertz (Hz), while intensity describes the sound's loudness and is measured in decibels (dB). Decibels are measured using a logarithmic scale. A sound level of 10 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above about 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels. The minimum change in the sound level of individual events that an average human ear can detect is about 3 dB. An increase (or decrease) in sound level of about 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness, and this relation holds true for loud sounds and for quieter sounds.

Because of the logarithmic nature of the decibel unit, sound levels cannot be added or subtracted directly and are somewhat cumbersome to handle mathematically. However, some simple rules of thumb are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus, for example:

60 dB + 60 dB = 63 dB

80 dB + 80 dB = 83 dB

Hertz is a measure of how many times each second the crest of a sound pressure wave passes a fixed point. For example, when a drummer beats a drum, the skin of the drum vibrates a number of times per second. A particular tone that makes the drum skin vibrate 100 times per second generates a sound pressure wave that is oscillating at 100 Hz, and this pressure oscillation is perceived as a tonal pitch of 100 Hz. Sound frequencies between 20 Hz and 20,000 Hz are within the range of sensitivity of the best human ear.

Sound from a tuning fork (a pure tone) contains a single frequency. In contrast, most sounds one hears in the environment do not consist of a single frequency, but rather a broad band of frequencies differing in sound level. The method commonly used to quantify environmental sounds consists of evaluating all of the frequencies of a sound according to a weighting system that reflects that human hearing is less sensitive at low frequencies and extremely high frequencies than at the mid-range frequencies. This is called "A" weighting, and the decibel level measured is called the A-weighted sound level (dBA). In practice, the level of a noise source is conveniently measured using a sound level meter that includes a filter corresponding to the dBA curve.

Although the A-weighted sound level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources that creates a relatively steady background noise in which no particular source is identifiable. A single descriptor called the Leq (equivalent sound level) is used. Leq is the energy-mean A-weighted sound level during a measured time interval. It is the "equivalent" constant sound level that would have to be produced by a given source to equal the fluctuating level measured.

Finally, another sound measure known as the Average Day-Night Noise Level (Ldn) is defined as the A-weighted average sound level for a 24-hour day. It is calculated by adding a 10 dB penalty to sound levels in the night (10:00 p.m. to 7:00 a.m.) to compensate for the increased sensitivity to noise during the quieter evening and nighttime hours. Sound levels of typical noise sources and environments are provided in Table 3.18-1 as a frame of reference.

TABLE 3.18-1
SOUND LEVELS OF TYPICAL NOISE SOURCES AND NOISE ENVIRONMENTS
(A-WEIGHTED SOUND LEVELS)

Noise Source (at a Given Distance)	Scale of A-Weighted Sound Level in Decibels (dBA)	Noise Environment	Human Judgment of Noise Loudness (Relative to a Reference Loudness of 70 Decibels*)
Military Jet Take-off with After-burner (50 ft)	140		
Civil Defense Siren (100 ft)	130	Carrier Flight Deck	
Commercial Jet Take-off (200 ft)	120		**Threshold of Pain** *32 times as loud
Pile Driver (50 ft)	110	Rock Music Concert	*16 times as loud
Ambulance Siren (100 ft) Newspaper Press (5 ft) Power Lawn Mower (3 ft)	100		**Very Loud** *8 times as loud
Motorcycle (25 ft) Propeller Plane Flyover (1,000 ft) Diesel Truck, 40 mph (50 ft)	90	Boiler Room Printing Press Plant	*4 times as loud
Garbage Disposal (3 ft)	80	High Urban Ambient Sound	*2 times as loud
Passenger Car, 65 mph (25 ft) Living Room Stereo (15 ft) Vacuum Cleaner (3 ft) Electric Typewriter (10 ft)	70		**Moderately Loud** *70 decibels (Reference Loudness)
Normal Conversation (5 ft) Air Conditioning Unit (100 ft)	60	Data Processing Center Department Store	*1/2 as loud
Light Traffic (100 ft)	50	Private Business Office	*1/4 as loud
Bird Calls (distant)	40	Lower Limit of Urban Ambient Sound	**Quiet** *1/8 as loud
Soft Whisper (5 ft)	30	Quiet Bedroom	
	20	Recording Studio	**Just Audible**
	10		**Threshold of Hearing**

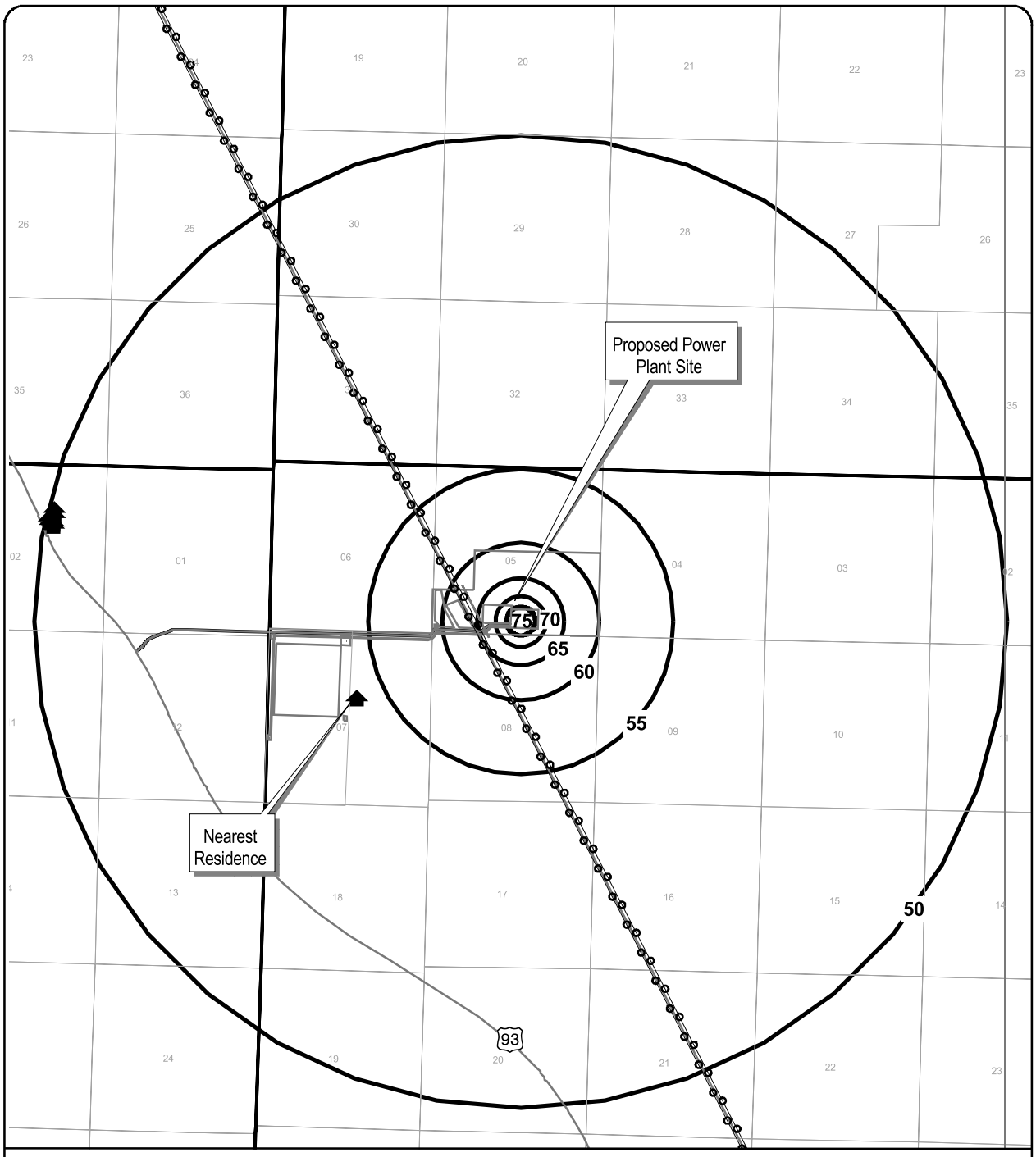
3.18.1.2 Region of Influence

The region of influence is based on the location of noise sensitive receptors, such as residences, relative to the plant, the pipeline corridors, and the communication facility locations, and the radius of the significant noise contours.

3.18.1.3 Existing Conditions

The ambient noise in the vicinity of the Project area is typical of a rural area. Noise was measured for a 24-hour period on Friday, June 9, 2000 at 8:00 a.m. (Caithness 2000). Noise was measured within 150 feet of the nearest residence to the proposed power plant site (Figure 3.18-1). A Metrosonics DB3080 noise meter, set to record the average noise (L_{eq} dBA) in 30-minute intervals, was used to measure the noise. The A-weighted scale was used to measure noise and the slow response option (five measurements per second) was applied.

The general background noise was 42.5 dBA. The exception was when unrelated construction activities (water well drilling and pipeline trench construction) were occurring from 8:00 a.m. to noon. During this time, the average background



Legend

Resource Components

- Noise Impact Contour Values in A-Weighted Decibles (LEQ)
- Residence

General Reference

- Mead-Liberty/Mead-Phoenix Transmission Lines
- U.S. Route

0.5 0 0.5 1

Scale in Miles

Universal Transverse Mercator Projection
1927 North American Datum
Zone 12

Noise Impacts

Big Sandy Energy Project EIS

N

Figure 3.18-1

x:/bigsandy/projects/noise.apr

noise was about 58 dBA. The graphical representation of the 24-hour noise survey is shown on Figure 3.18-2. During the 24-hour period, the average noise was 45.9 dBA. Figure 3.18-3 shows the noise level (51.8 dBA) from 8:00 a.m. to noon when construction was occurring. Figure 3.18-4 shows the background noise (42.5 dBA) recorded from noon until 8:00 a.m. the next morning in the absence of construction activities. This is assumed to be the typical background noise level for the general Project area. Sound levels at specific locations would be dependent on that location's proximity to existing noise sources such as roadways and industrial and agricultural equipment.

3.18.2 Environmental Consequences

3.18.2.1 Identification of Issues

The following issues were identified during the preparation of this noise analysis:

- Potential noise impacts from operation of the proposed power plant.
- Potential noise impacts from construction of all Project facilities including the access road, wells, and natural gas pipeline.

3.18.2.2 Significance Criteria

Significance criteria were based on Mohave County noise standards and EPA noise compatibility guidelines, as described below.

Mohave County

The Mohave County General Plan identifies sound levels that are considered to be compatible with various land uses. Sound levels up to 65 dBA Ldn are considered compatible with residential land uses. Implementation measure N2 of the General Plan "requires developments which generate offsite noise levels in excess of 65 dBA Ldn to mitigate noise levels so they do not exceed the County's standards."

U.S. Environmental Protection Agency

The EPA has published acoustical guidelines designed to protect the public health and welfare with an adequate margin of safety. The guidelines are presented in Table 3.18-2. The guidelines classify the various areas according to the primary activities that are most likely to occur in each. A review of the table shows that an indoor noise environment of 45 dBA Ldn will permit speech communication in homes, while an outdoor Ldn not exceeding 55 dBA will permit normal speech communication. An $Leq_{(24)}$ of 70 dB is identified as protecting against damage to hearing.

Therefore, impacts related to noise would be considered significant if the EPA guidelines of 55 dBA $Leq_{(24)}$ at the nearest residence was exceeded or if the county standard of 65 dBA Ldn would be exceeded.

3.18.2.3 Impact Assessment Methods

The assessment of noise impacts required the identification of Project-related noise sources and the location of noise-sensitive receptors. Acoustical calculations were performed to estimate the noise levels from Project construction and operation at the closest noise-sensitive receptors. Impacts were based on the Project's compliance with applicable noise criteria, as reflected in the significance criteria.

3.18.2.4 Actions Incorporated Into the Proposed Action to Reduce or Prevent Impacts

The Proposed Action incorporates the following noise abatement measures to reduce or prevent impacts:

Noise reduction measures would be included in the design of the turbines and the turbine housing. The air intake system would include silencers to reduce noise from the combustion turbine compressor inlet. The turbines would be contained within an insulated shell to further reduce noise levels.

TABLE 3.18-2
YEARLY AVERAGE EQUIVALENT SOUND LEVELS IDENTIFIED AS REQUISITE TO PROTECT THE PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

	Measure	Indoor			Outdoor		
		Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects(b)	Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects(b)
Residential with Outside Space and Farm Residences	Ldn	45		45	55		55
	$L_{eq}(24)$		70			70	
Residential with No Outside Space	L_{dn}	45		45			
	$L_{eq}(24)$		70				
Commercial	$L_{eq}(24)$	(a)	70	70(c)	(a)	70	70(c)
Inside Transportation	$L_{eq}(24)$	(a)	70	(a)			
Industrial	$L_{eq}(24)$(d)	(a)	70	70(c)	(a)	70	70(c)
Hospitals	L_{dn}	45		45	55		55
	$L_{eq}(24)$		70			70	
Educational	$L_{eq}(24)$	45		45	55		55
	$L_{eq}(24)$(d)		70			70	
Recreational Areas	$L_{eq}(24)$	(a)	70	70(c)	(a)	70	70(c)
Farm Land and General Unpopulated Land	$L_{eq}(24)$				(a)	70	70(c)

Source: EPA 1974

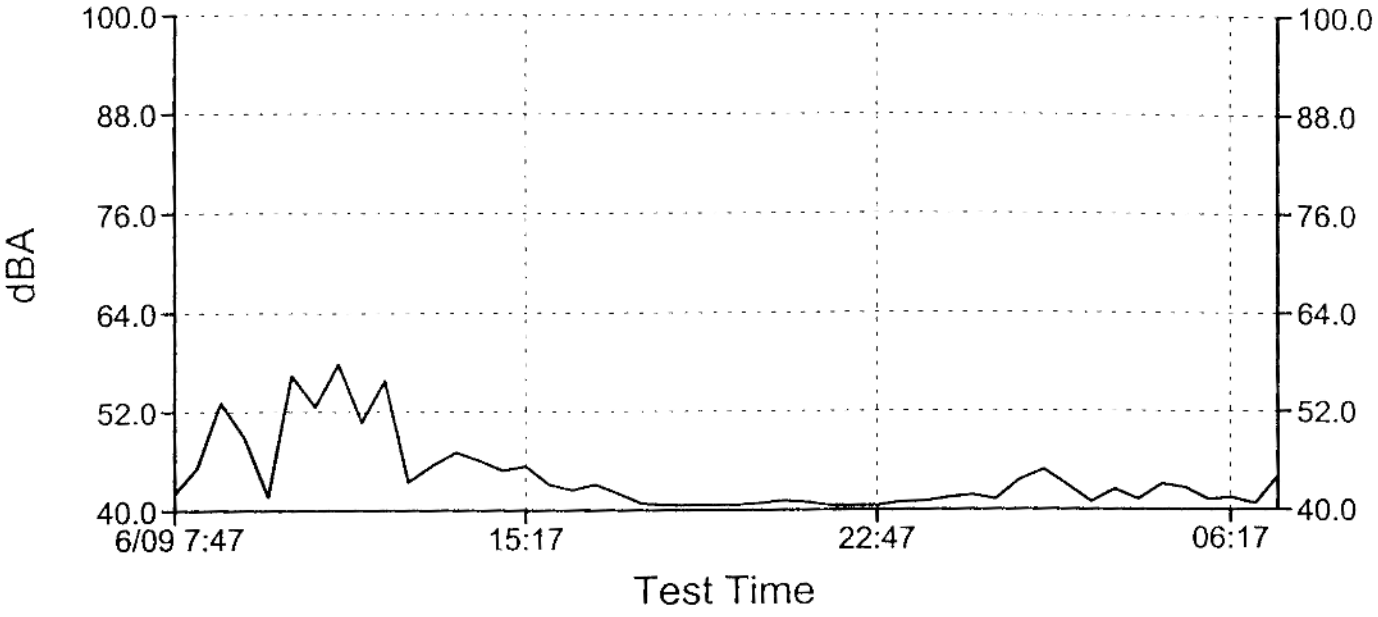
CODE:

(a) Since different types of activities appear to been associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity

(b) Based on lowest level.

(c) Based only on hearing loss.

(d) An $L_{eq(8)}$ of 75 dB may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average (i.e., no greater than 1 db.)

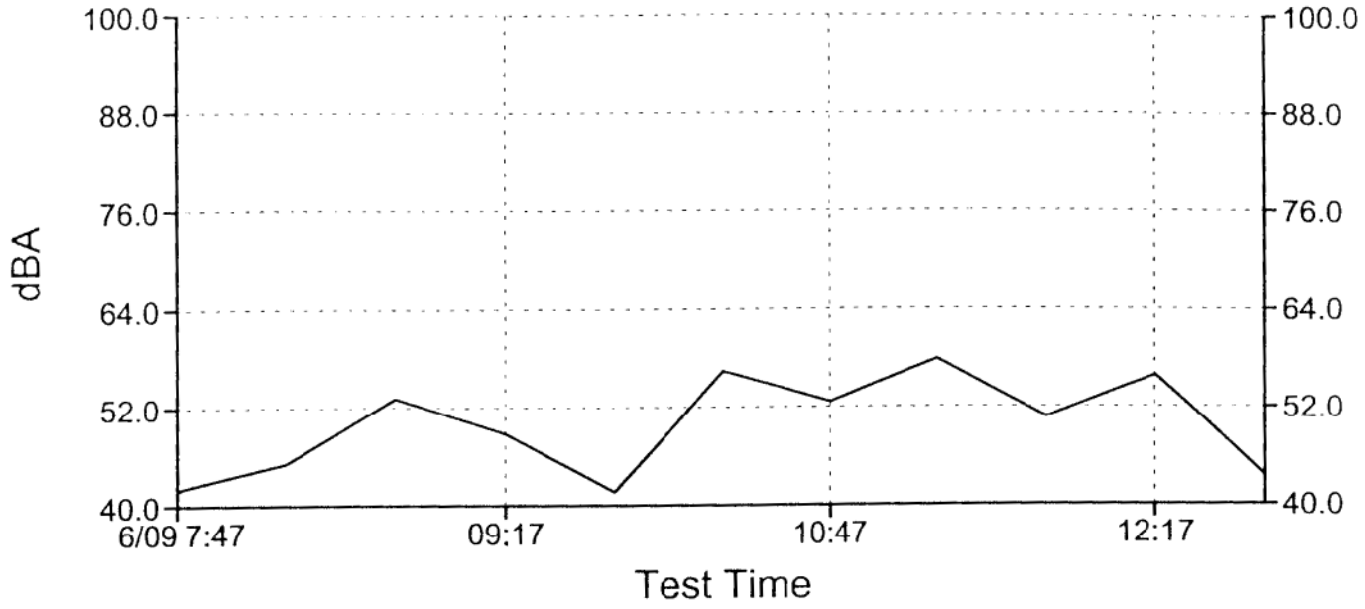


Overall Leq = 45.9db

24-hour Noise Survey Results

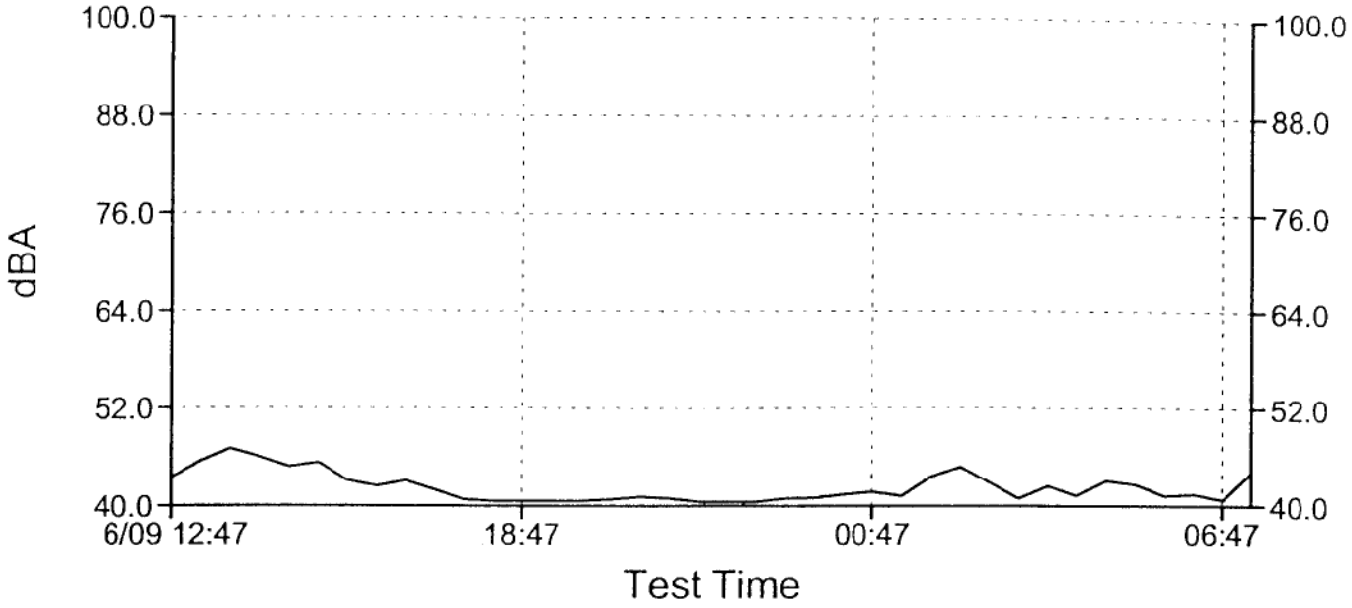
Big Sandy Energy Project EIS

Figure 3.18-2



Overall Leq = 51.8db
During Construction Activities

Noise Survey Results During Construction
Big Sandy Energy Project EIS
Figure 3.18-3



Overall Leq = 42.5db
No Construction Activities

Background Noise with No Construction Activities
Big Sandy Energy Project EIS
Figure 3.18-4

- Construction other than well drilling is anticipated to occur 10-hours per day, 5 days per week, thereby limiting the potential for noise on nights and weekends. Construction equipment would be required to have manufacturer's recommended mufflers.

3.18.2.5 Impact Assessment

Proposed Action

Proposed Power Plant

Construction of the power plant would result in a temporary increase in the ambient noise level in the vicinity of the construction activity. The magnitude of the impact depends on the type of construction activity, noise level generated by various pieces of construction equipment, duration of the construction phase, distance between the noise source and receiver, presence or absence of noise barriers, and time of day. Figure 3.18-5 shows noise levels generated by typical pieces of construction equipment. The construction noise is anticipated to be generated only during daylight hours, and would be temporary.

Noise is produced during the operation of a power plant. The primary noise sources at a typical power plant include combustion turbine generators (CTGs) and associated CTG air inlets, heat recovery steam generators (HRSGs), steam turbine generators (STGs), cooling tower fans, transformer areas, feed pumps (i.e., boiler, return, and circulation), and ancillary switchgear. The overall noise level generated by these components would depend on the physical layout of the facility, numbers of individual equipment units, and mitigation measures incorporated into the facility design.

Equipment needed to operate the proposed power plant has a guaranteed noise limit of 66 dBA at 400 feet from the "noise envelope" of the equipment. The noise envelope encloses the turbines, HRSG, STG, cooling towers, and ancillary equipment. It must be noted that this is the noise at steady state (100 percent load) baseload operation exclusive of transients, startup and shutdown, pulse filter cleaning, HRSG duct firing, steam bypass, atmospheric venting, and other off-normal and emergency conditions. However, this guarantee is for a two-on-one 520-MW configuration (two turbines, two HRSGs, and one STG). As a conservative estimate of the extra one-on-one configuration (one turbine, one HRSG, and one STG planned for Phase 2), it is assumed that the noise estimate of a one-on-one configuration would be similar, although the one-on-one configuration has one less turbine. The proposed configuration is thus assumed to generate approximately 69 dBA Leq at the 400 feet "noise envelope" of the equipment.

Acoustical calculations were performed to estimate the Project-generated sound level at various distances from the power plant fence line. Calculations assumed that the sound level from the Project components would be constant and would decay based on "point source" acoustical characteristics. A point source decays sound at a rate of 6 dB per doubling of distance from the source-receiver pair. This is a logarithmic relationship describing the acoustical spreading of a pure undisturbed spherical wave in air. The effects of atmospheric absorption, ground attenuation, and intervening topography and structures that may further reduce propagated noise levels, were not considered due to many uncertainties. Therefore, the results are considered to be the worst case.

The results of the calculations are summarized in Table 3.18-3. The predicted noise level at 400 feet represents the closest point of the noise envelope to the southern property boundary, and thus represents the highest noise level off the proposed power plant site. Since all other plant facilities would be farther from the property boundary, the predicted noise along the southern property line represents the maximum "fence line" noise. A review of Table 3.18.3 shows that the 65 dBA Ldn Mohave County compatibility requirement is located at approximately 910 feet from the fence line. The EPA 55 dBA Ldn compatibility guideline is located approximately

Table 3.18-3 PREDICTED NOISE LEVELS FROM BIG SANDY POWER PLANT			
Distance from Big Sandy Power Plant (feet)	Average Hourly Noise Level from Big Sandy Power Plant (L_{eq})	Average Hourly Noise Level from Big Sandy Power added to Measured Ambient Noise (Leq)	Total Day/Night Noise Level (Ldn)
Fence line	69.0	69.0	75.4
100	67.1	67.1	73.5
600	61.0	61.1	67.5
910	58.2	58.7	65.0
1,600	55.0	55.3	61.7
2,600	51.5	52.0	58.4
3,600	49.0	49.9	56.3
4,600	47	48.4	54.8
5,045 (nearest residence)	46.3	47.8	54.2
5,600	45.5	47.2	53.6
6,600	44.1	46.4	52.8
7,600	43.0	45.8	52.2
8,600	42.0	45.2	51.6
9,600	41.0	44.8	51.2

4,000 feet from the fence line. No residences are located within the 55 dBA or the county 65 dBA Ldn noise contour. Therefore, no significant noise impacts would be expected from power plant operation.

Proposed Access Road, Water Pipelines, and Wells

No residences are located in close proximity of the proposed access road and wells; therefore, no significant noise impacts would occur.

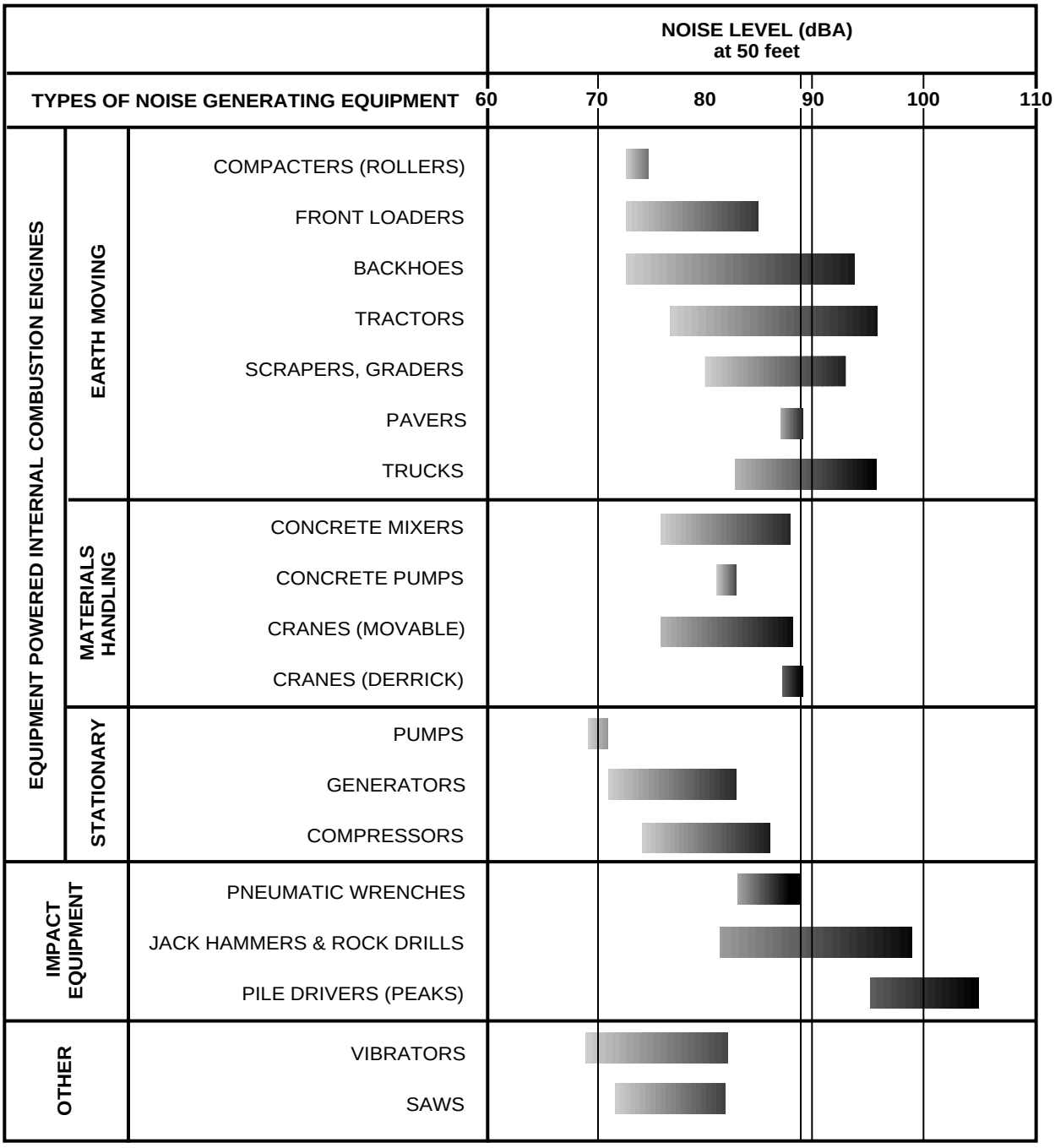
Communication Facilities

Noise impacts from installation of the OPGW option or microwave option would be short term and small in magnitude due to the limited time frame of construction activity. Accordingly, any one location would be affected only for only three to five days for the OPGW, each of the 15 pulling sites would be about 3 miles apart and ground disturbance activities would last only 1 or 2 day(s) of the 75-day construction period at each site. The slightly elevated noise levels associated with construction vehicles would cease after construction or installation activities cease. All of the construction activities are expected to occur within the existing right-of-way and would be temporary.

Proposed Gas Pipeline Corridor

As described in Section 2.0, the corridor for the proposed natural gas pipeline would include corridor segments R1, C1, T3, C3, T4, and R5. Noise sensitive receptors along each corridor segment are described below.

Corridor segment R5 follows the alignment of the proposed access road west to US 93, turns north and follows along the east side of the US 93 to the intersection of the highway and the



Typical Construction Equipment Noise Generation Levels

Figure 3.18-5

Mead-Phoenix Project 500-kV transmission line. This corridor segment crosses the Big Sandy River and through the community of Wikieup. There are four residences that would be located in or near the corridor segment just south of Wikieup.

Through about 2 miles of Wikieup the land in the corridor tends to be partially to completely disturbed by development and ranching activities; there are up to 15 residences and up to 6 businesses, including a gas station, located in or near the pipeline corridor.

Corridor segment T4 parallels each side the Mead-Phoenix Project 500-kV and Mead-Liberty 345-kV transmission lines through a designated 1-mile wide utility corridor. There are four residences located in the corridor, several along US 93; five additional residences are located between the highway and the transmission line corridor. Despite the residences, a majority of this corridor is undisturbed rangeland that is used for grazing.

Similar to corridor segment T4, the land within corridor segment C3 includes relatively undisturbed areas used for grazing. There are no residences located in this corridor segment.

Corridor segment T3 includes relatively undisturbed rangeland, though some development is present toward the northern end of the corridor segment. There is one residence within this corridor segment.

Corridor segment C1 crosses undeveloped rangeland that is used for grazing. The corridor crosses both Old US 93 and US 93. Old US 93 is a well-maintained dirt road that provides access to Windmill Ranch residences (40-acre parcel residential area) and Sierra Vista Estates (residential subdivision in Section 13, T20N, R14W)

Corridor segment R1 parallels Hackberry Road, a dirt road maintained by Mohave County. The corridor crosses through relatively undisturbed rangeland that is used for grazing. Disturbance is limited to access roads, an old mining area (Section 3, T20N, R13W), and one residence located along the east side of the road (Section 3, T20N, R13W).

Noise from pipeline construction is anticipated to be short term and temporary, and would occur only during the daytime hours.

Alternative Gas Pipeline Corridors

The alternative natural gas pipeline corridors follow entirely along road alignments (Alternative R) or entirely along the transmission line alignment (Alternative T). Noise sensitive receptors near each corridor segment, which have not been described under the proposed corridor, are described below.

Corridor segment R4 includes areas east of and adjacent to the US 93 right-of-way. The land is relatively undisturbed and is primarily used for grazing, though there are some scattered residences. This corridor segment also crosses through the Carrow-Stevens Ranches ACEC (refer to Section 3.10). There are about eight residences located within the corridor along the east side of US 93; additional residences are present outside of the corridor segment to the east of the corridor segment and west of US 93.

The land uses present in corridor segment R3 are very similar to those described for corridor segment R4. There are about four residences located within the corridor segment; additional residences are present outside the corridor segment and along the west side of US 93.

Corridor segment R2 follows along Hackberry Road, which is an unpaved public road reportedly maintained by Mohave County. The land in the area is undisturbed; there are no developed uses except one residence that is located outside the corridor segment.

Corridor segment T5 generally follows the Mead-Phoenix Project 500-kV and Mead-Liberty 345-kV transmission lines from the plant site to its intersection with US 93, except for the

area where the corridor segment crosses the Big Sandy River. There are about four residences located in this corridor segment.

Corridor segment T2 is primarily undisturbed rangeland. There are two residences located in the corridor segment and one additional residence just outside the corridor segment.

Land uses in corridor segment T1 are similar to those described for corridor segment T2; there are no residences located in this corridor segment.

Corridor segment C2 follows Old US 93. This corridor segment is narrow, including only the road right-of-way. The land use near the road is generally grazing—there are a few scattered residences (on minimum 40-acre parcels).

Noise from pipeline construction would be short-term and temporary, and would occur only during the daytime during the week.

No-Action Alternative

- The Project would not be developed under the No-Action Alternative. Under this alternative, Project generated sound levels identified in the sections above would not occur.

3.18.2.6 Mitigation and Residual Impacts

- No significant impacts would result from the implementation of the Proposed Action with the actions incorporated to reduce or prevent impacts. No measures to mitigate adverse impacts have been identified for noise. There would be no residual significant impacts.